

REMARKS

Applicants respectfully request reconsideration of this application, and reconsideration of the Office Action dated April 5, 2005. Upon entry of this Amendment, claims 4-7, 13, 16, 17, 20, 25, 26, 29, 30 and 34-37 will remain pending in this application. Claim 16 has been placed into independent form by incorporating the subject matter of Claims 1 and 2 therein. No substantive change has been made to claim 16 and therefore the claim has not been narrowed from its original scope. New claim 59 has been added. The new claim is supported by the specification and original claims. No new matter is incorporated by this Amendment.

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Applicants begin by addressing rejections made over alleged prior art. First, Claims 1, 2, and 4 were rejected under 35 U.S.C. § 102(e) as purportedly anticipated by Mauk (U.S. Pat. No. 5,828,088). Claims 1, 2, and 4 were rejected under 35 U.S.C. § 103(a) as purportedly obvious based on Usui et al. (Thick GaN Epitaxial ...) or Zheleva (Dislocation density reduction...) in view of Tischler et al. (U.S. Pat. No. 5,679,152). Claims 1, 2, 4, and 7 are rejected under 35 U.S.C. § 103(a) as purportedly obvious based on Usui et al. or Zheleva in view of Shakuda (U.S. Pat. No. 5,838,029). Claims 5, 6, 16, 17, 20, 25, 26, 29 and 30 are rejected under 35 U.S.C. § 103(a) as purportedly obvious based on Usui et al. or Zheleva in view of Tischler or Shakuda, and further in view of Mauk. Claim 13 is rejected under 35 U.S.C. § 103(a) as purportedly obvious based on Usui et al. or Zheleva in view of Tischler or Shakuda, and further in view of Tadamoto (U.S. Pat. No. 5,770,887). Claims 34 and 36 are rejected under 35 U.S.C. § 103(a) as purportedly obvious based on Usui et al. or Zheleva in view of Tischler or Shakuda, and further in view of IBM (Abstract). Claims 35 and 37 are rejected under 35 U.S.C. § 103(a) as purportedly obvious based on Usui et al. or Zheleva in view of Tischler or Shakuda, and further in view of IBM, and further in view of Inoue (U.S. Pat. No. 5,182,233). Applicants respectfully traverse all of these rejections together.

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Independent claim 16 (from which the remaining claims all ultimately depend) concerns a method of making a GaN single crystal substrate. The method includes forming, on a GaAs substrate, a mask layer having a plurality of opening windows particularly disposed with respect to each other. Specifically, claim 16 describes, during the mask layer forming, arranging of the opening windows with a pitch in a <10-10> direction so as to form a <10-10> window group. Further, claim 16 describes arranging a plurality of <10-10> window groups in parallel with a pitch d defined as $0.75L \leq d \leq 1.3L$ in the direction <1-210>.

In order to ensure full understanding and appreciation of claim 16, reference will be made to the description of Applicants' third embodiment beginning at page 27 of the specification. This embodiment is illustrated in Figures 8A through 10B. This embodiment is similar to Applicants' other embodiments in the basic sequence of fabrication steps. These are illustrated in Figures 8A through 8D. The window description as recited in claim 16 corresponds to Figures 9 and 10, and for example, the corresponding description beginning in the first full paragraph on page 30. Note that the opening windows 30 in the mask layer 28 are arranged in three columns (of two rows of windows each). The windows in each column are separated by a distance related to the "pitch", L, that separates the top of one window from the top of the window below it. This pitch, L, applies to the windows in each of the three columns. Moreover, please note that the windows of each column are spaced from each other by a second pitch, d. In Figure 9, pitch, d, is the distance between the right side of the windows in the left-most column and the right side of the windows in the middle column. Both pitches L and d are described and related to each other in claim 16 namely, $0.75L \leq d \leq 1.3L$.

At this time, mention also should be made of claim 17. Claim 17 recites the upward shift of the middle column with respect to the leftmost and rightmost columns. As recited in claim 17 and as clearly seen from Figure 9, this shift is set at a distance L/2.

To complete understanding of the invention, reference now is made to page 31 of the specification together with Figures 10A and 10B. Due to the arrangement of window groups (window columns and rows), GaN crystal grains 36 develop as truncated hexagonal pyramids. Figure 10A shows these GaN crystals in an early state of growth. From Figure 10B and text page 31, it is appreciated that these hexagonal pyramids will grow together without interstices. This is how the Applicants accomplish an important object of their invention, namely to reduce “true” internal stress.

Applicants courteously urge that none of the patents applied in the above-listed rejections teaches or suggests their method as described in claim 16. That is, none of the asserted prior art documents discloses Applicants’ particular arrangements of windows, where windows in a column are spaced according to a first pitch, L, and the columns themselves are separated by a second pitch, d, that is no less than 0.75L and no greater than 1.3L in the <1-210> direction. For these reasons, Applicants courteously urge that all of the rejections fall together in failing to render the remaining claims anticipated and/or obvious. For at least these reasons, Applicants courteously solicit withdraw of all of the above-listed rejections.

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Next, claims 16, 17, 25 and 26 are rejected under 35 U.S.C. 112, second paragraph, as purportedly indefinite. Specifically, the Office Action asserts that these claims are indefinite because “L” is not defined. Applicants respectfully traverse.

As discussed above, “L” is used to refer to a pitch value (so is “d”). The above-discussed section of the specification and corresponding drawings clearly defines L and d for those of ordinary skill in the GaN crystal art. Hence the rejection is overcome.

Before closing, brief mention is made of new claim 59. Applicants note this claim in connection with the Mauk patent. Claim 59 recites vapor phase growing of the upper epitaxial layer made of GaN on the mask layer. Applicants point out that Mauk discloses only a liquid phase epitaxy process (see column 5, lines 17-21) and thus does not suggest vapor phase growing as recited in the claim.

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Applicants respectfully submit that this Amendment and the above remarks obviate the outstanding rejections in this case, thereby placing the application in condition for immediate allowance. Allowance of this application is earnestly solicited.

If any fees under 37 C.F.R. §§ 1.16 or 1.17 are due in connection with this filing, please charge the fees to Deposit Account No. 02-4300; Order No. 033035.0341.

If an extension of time under 37 C.F.R. § 1.136 is necessary that is not accounted for herewith, such an extension is requested. The extension fee should be charged to Deposit Account No. 02-4300; Order No. 033035.0341.

Respectfully submitted,
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